Space Technology Research Grants

Certification of Additive Manufacturing Processing Parameters through Physics-Based Predictive Simulation of Process-Defects-Microstructure
Completed Technology Project (2017 - 2020)

Project Introduction

Additive manufacturing (AM), also known as 3D printing, is a next generation technology for cost-effective and accelerated way of manufacturing complex-shaped metallic components by successively adding and melting layers of alloy powder directly controlled by a 3D computer-aided design dataset. It has many critical applications in NASA missions such as those found in propulsion and spacecraft. Prior to acceptance of AM processes by NASA, other government agency, and commercial space missions, however, a longstanding technical challenge is the qualification and certification of AM processes and systems for critical, high-value metallic components. The main objective of the proposed research is to develop a physics-based, predictive modeling approach for a rigorous yet efficiency way of certification of AM processing parameters, alloy composition, and resulting microstructures for the desired properties of metallic components via Laser-Powder Bed Fusion (L-PBF) AM process. Particularly, an integrated process-microstructure models will make it attainable for significantly new capable for multiple laser passes, drastically improving the relevance of process-microstructure models to actual AM production scenario.

Anticipated Benefits

Significantly new capable for multiple laser passes, drastically improving the relevance of process microstructure models to actual AM production scenario. Foundation to enable predictive modeling based approaches to certify both the L-PBF and allied AM processes as well as the resulting AM-manufactured flight hardware.

Certification of Additive Manufacturing Processing Parameters through Physics-Based Predictive Simulation of Process-Defects-Microstructure
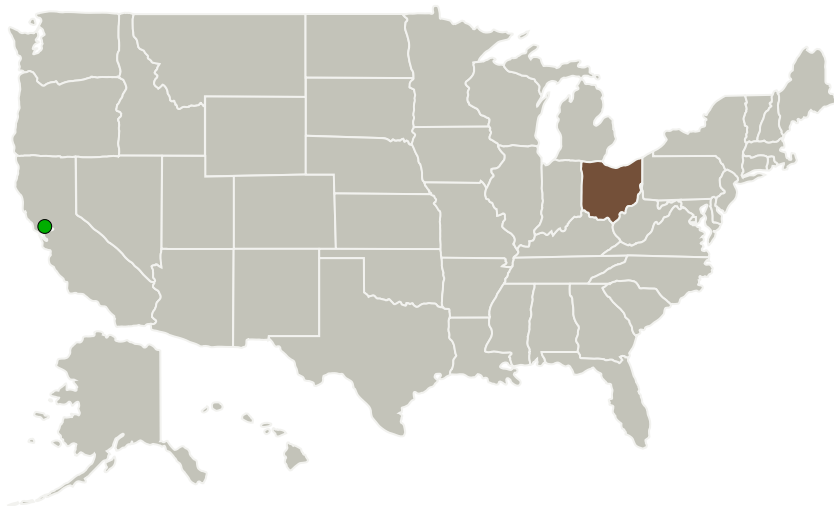
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Primary U.S. Work Locations and Key Partners

Organizations Performing Work	Role	Type	Location
Ohio State University-Main Campus	Lead Organization	Academia	Columbus, Ohio
⬤Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations
Ohio

Project Website:

https://www.nasa.gov/strg#.VQb6T0jJzyE

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Ohio State University-Main Campus

Responsible Program:

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Project Management
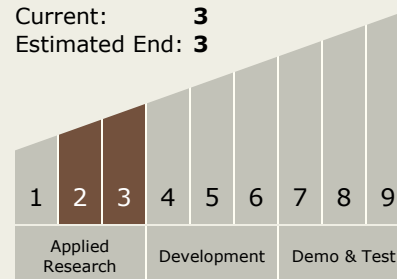
Program Director:

Claudia M Meyer

Program Manager:

Hung D Nguyen

Principal Investigator:

Wei Zhang

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**

1	2	3	4	5	6	7	8	9
	Applied Research			Development			Demo & Test	

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Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  └ TX12.4 Manufacturing
    └ TX12.4.2 Intelligent Integrated Manufacturing

Target Destination

Outside the Solar System